

(drawing 9001373), nut (drawing 9001336), and abdominal insert (drawing 127-8210), on resistance to articulation between upper torso assembly (drawing 127-2000) and lower torso assembly (drawing 127-3000).

(b)(1) When the upper torso assembly of a seated dummy is subjected to a force continuously applied at the head to neck pivot pin level through a rigidly attached adaptor bracket as shown in Figure N5 according to the test procedure set out in paragraph (c) of this section, the lumbar spine-abdomen assembly shall flex by an amount that permits the upper torso assembly to translate in angular motion until the machined rear surface of the instrument cavity at the back of the thoracic spine box is at  $45 \pm 0.5$  degrees relative to the vertical transverse plane, at which time the force applied as shown in Figure N5 must be not less than 147 N (33 lbf) and not more than 200 N (45 lbf), and

(2) Upon removal of the force, the torso assembly must return to within 8 degrees of its initial position.

(c) *Test procedure.* The test procedure for the torso assemblies is as follows:

(1) Soak the dummy in a controlled environment at any temperature between 18.9 and 25.6 °C (66 and 78 °F) and a relative humidity between 10 and 70 percent for at least four hours prior to a test.

(2) Attach the dummy (with or without the legs below the femurs) to the fixture in a seated posture as shown in Figure N5.

(3) Secure the pelvis at the pelvis instrument cavity rear face by threading four ¼ in cap screws into the available threaded attachment holes. Tighten the mountings so that the test material is rigidly affixed to the test fixture and the pelvic-lumbar joining surface is horizontal.

(4) Flex the thorax forward three times between vertical and until the torso reference plane, as shown in figure N5, reaches  $30 \pm 2$  degrees from vertical. Bring the torso to vertical orientation, remove all externally applied flexion forces, and wait 30 minutes before conducting the test. During the 30-minute waiting period, the dummy's upper torso shall be externally

supported at or near its vertical orientation to prevent sagging.

(5) Remove the external support and wait two minutes. Measure the initial orientation of the torso reference plane of the seated, unsupported dummy as shown in Figure N5. This initial torso orientation angle may not exceed 22 degrees.

(6) Attach the loading adapter bracket to the spine of the dummy, the pull cable, and the load cell as shown in Figure N5.

(7) Apply a tension force in the midsagittal plane to the pull cable as shown in Figure N5 at any upper torso deflection rate between 0.5 and 1.5 degrees per second, until the torso reference plane is at  $45 \pm 0.5$  degrees of flexion relative to the vertical transverse plane as shown in Figure N5.

(8) Continue to apply a force sufficient to maintain  $45 \pm 0.5$  degrees of flexion for 10 seconds, and record the highest applied force during the 10-second period.

(9) Release all force as rapidly as possible, and measure the return angle at 3 minutes or any time thereafter after the release.

#### §572.126 Knees and knee impact test procedure.

(a) *Knee assembly.* The knee assembly is part of the leg assembly (drawing 127-4000-1 and -2).

(b) When the knee assembly, consisting of knee machined (drawing 127-4013), knee flesh (drawing 127-4011), lower leg (drawing 127-4014), the foot assembly (drawing 127-4030-1(left) and -2 (right)) and femur load transducer (drawing SA572-S10) or its structural replacement (drawing 127-4007) is tested according to the test procedure in section 572.127(c), the peak resistance force as measured with the test probe mounted accelerometer must be not less than 2.0 kN (450 lbf) and not more than 3.0 kN (674 lbf).

(c) *Test procedure.* The test procedure for the knee assembly is as follows:

(1) Soak the knee assembly in a controlled environment at any temperature between 18.9 and 25.6 °C (66 and 78 °F) and a relative humidity from 10 to 70 percent for at least four hours prior to a test.

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(2) Mount the test material and secure it to a rigid test fixture as shown in Figure N6. No contact is permitted between any part of the foot or tibia and any exterior surface.

(3) Align the test probe so that throughout its stroke and at contact with the knee it is within 2 degrees of horizontal and collinear with the longitudinal centerline of the femur.

(4) Guide the pendulum so that there is no significant lateral vertical or rotational movement at time-zero.

(5) The test probe velocity at the time of contact shall be  $2.1 \pm 0.03$  m/s ( $6.9 \pm 0.1$  ft/s).

(6) No suspension hardware, suspension cables, or any other attachments to the probe, including the velocity vane, shall make contact with the dummy during testing.

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### § 572.127 Test conditions and instrumentation.

(a) The test probe for thoracic impacts, except for attachments, shall be of rigid metal or metal alloy construction and concentric about its longitudinal axis. Any attachments to the impactor, such as suspension hardware, velocity vanes, etc., must meet the requirements of § 572.124(c)(6). The impactor shall have a mass of  $2.86 \pm 0.02$  kg ( $6.3 \pm 0.05$  lb) and a minimum mass moment of inertia of  $160 \text{ kg-c}^2$  ( $0.141 \text{ lb-in-sec}^2$ ) in yaw and pitch about the CG of the probe. One third of the weight of suspension cables and any attachments to the impact probe must be included in the calculation of mass, and such components may not exceed five percent of the total weight of the probe. The impacting end of the probe, has a flat, continuous, and non-deformable  $101.6 \pm 0.25$  mm ( $4.00 \pm 0.01$  in) diameter face with an edge radius of  $7.6/12.7$  mm ( $0.3/0.5$  in). The impactor shall have a  $101\text{--}103$  mm ( $4.0\text{--}4.1$  in) diameter cylindrical surface extending for a minimum of  $12.5$  mm ( $0.5$  in) to the rear from the impact face. The probe's end opposite to the impact face has provisions for mounting an accelerometer with its sensitive axis collinear with the longitudinal axis of the probe. The impact probe shall have a free air resonant frequency of not less than  $1000$  Hz

limited to the direction of the longitudinal axis of the impactor.

(b) The test probe for knee impacts, except for attachments, shall be of rigid metal or alloy construction and concentric about its longitudinal axis. Any attachments to the impactor, such as suspension hardware, velocity vanes, etc., must meet the requirements of § 572.126(c)(6). The impactor shall have a mass of  $0.82 \pm 0.02$  kg ( $1.8 \pm 0.05$  lb) and a minimum mass moment of inertia of  $34 \text{ kg-cm}^2$  ( $0.03 \text{ lb-in-sec}^2$ ) in yaw and pitch about the CG of the probe. One third of the weight of suspension cables and any attachments to the impact probe must be included in the calculation of mass, and such components may not exceed five percent of the total weight of the probe. The impacting end of the probe, has a flat, continuous, and non-deformable  $76.2 \pm 0.2$  mm ( $3.00 \pm 0.01$  in) diameter face with an edge radius of  $7.6/12.7$  mm ( $0.3/0.5$  in). The impactor shall have a  $76\text{--}77$  mm ( $3.0\text{--}3.1$  in) diameter cylindrical surface extending for a minimum of  $12.5$  mm ( $0.5$  in) to the rear from the impact face. The probe's end opposite to the impact face has provisions for mounting an accelerometer with its sensitive axis collinear with the longitudinal axis of the probe. The impact probe shall have a free air resonant frequency of not less than  $1000$  Hz limited to the direction of the longitudinal axis of the impactor.

(c) Head accelerometers shall have dimensions, response characteristics, and sensitive mass locations specified in drawing SA572-S4 and be mounted in the head as shown in drawing 127-0000 sheet 3.

(d) *Neck force/moment transducer.* (1) The upper neck force/moment transducer shall have the dimensions, response characteristics, and sensitive axis locations specified in drawing SA572-S11 and be mounted in the head-neck assembly as shown in drawing 127-0000 sheet 3.

(2) The optional lower neck force/moment transducer shall have the dimensions, response characteristics, and sensitive axis locations specified in drawing SA572-S26 and be mounted as shown in drawing 127-0000 sheet 3.